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(54) INHALATION ACTUABLE DISPENSING DEVICE

(71) We, ARMSTRONG-KROPP DEVELOPMENT CORPORATION, a Corporation organised and existing under the laws of the Commonwealth of Masschusetts, United States of America, of 423 LaGrange Street, West Roxbury, Massachusetts, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The invention relates to inhalation actuable dispensing devices of the type which dispense an atomised compound from a pressurised aerosol dispensing container for inhalation such as by respiratory tract patients.

It is now fairly common practice to dispense pharmaceutical compounds from pressurised aerosol containers which upon triggering by finger depression of their valves eject a metered amount of the pressurised compound. Such finger operated devices are often unsatisfactory because of the difficulty of fairly exact correlation of their control with the breathing rhythm of the patient. Especially in the case of children and aged people, the patient is in many instances unable to co-ordinate his breathing with the valve manipulation. Also, conventional devices of this type do not sufficiently guard against the application of over-dosages of respiratory drugs which are sometimes very potent and may produce unwanted side effects. Dangerous over-dosage is not at all uncommon with such conventional devices because their users are mainly patients who are short of breath and liable to experience confused breathing of irregular cycle. Such patients are tempted to provide additional inhalation by triggering their device when they sense that their breathing is not deep enough or that the previously discharged inhalation was not applied at the most advantageous portion of the breathing cycle. Inhalation devices of this type are for example disclosed in United States Specifications Nos. 2,693,178, 3,157,179 and 3,238,940.

U.S. Patent Specification No. 3,187,748 discloses a breath controlled aerosol discharging device wherein the discharge is not metered by a conventional aerosol dispenser itself but by a rather cumbersome valving mechanism directly driven by a breath actuated vane. Due to the limited force available from the vane and the large inertia of the valving mechanism and the linkage between vane and metering components, the discharge operation proper as well as the timing between actuating breath and discharge are uncertain. Also, the metering component cannot be easily cleaned and accumulates uncontrollable amounts of medication material. U.S. Patent Specification No. 3,157,179 discloses a breath controlled inhalation device wherein the discharge is metered by a special apparatus, not part of the conventional aerosol dispenser, which has to be manually filled prior to each use, the metering chamber being empty or filled depending on the user's choice without indication of the condition, which introduces considerable uncertainty. The breath responsive releasing mechanism is complicated and unduly energy consuming, and thus inherently of uncertain effectiveness.

According to the present invention there is provided an inhalation actuable dispensing device for use with a pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle which is capable of releasing a metered amount of an aerosol compound upon relative movement of the valve nozzle and the container body towards one another, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means responsive to suction applied to said mouthpiece to release said latch means, whereby in use of the device said actuating means causes actuation of the valve of

said aerosol dispensing container and discharge of a metered amount of an aerosol compound into the chamber in the vicinity of the mouthpiece.

According to one aspect of the invention there is provided an inhalation actuable dispensing device for use with a conventional pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle and being of the type which is capable of releasing a metered amount of an aerosol compound on depression of the valve nozzle, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means, disposed within said chamber for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means comprising a moveable wall portion of the chamber which is deflectable in response to suction applied to the mouthpiece to release said latch-means, whereby in use of the device said actuating means causes depression of the valve of the aerosol dispensing container and discharge of a metered amount of aerosol compound into the chamber in the vicinity of the mouthpiece.

When using an inhalation device in accordance with the present invention, the patient is able to administer a single metered amount of the respiratory drug when the inhalation force has reached the most suitable level for accepting medication without consciously having to co-ordinate his breathing to the operation of the device.

A preferred feature of the invention minimizes over-dosage by requiring manual resetting of the device prior to each discharge and a further preferred feature is to utilise the metering provisions of readily available pressurised aerosol containers which provide the metered discharge immediately after each previous discharge without a special metering manipulation.

In one embodiment the triggering means comprises a moveable wall portion of the chamber (e.g. a piston member, bellows or flexible membrane) which is deflectable in response to suction applied to the mouthpiece. Conveniently the moveable wall member may be provided with an aperture cover.

Inhalation devices in accordance with the invention include an air admission port which may be open while the device is in use to enable the user to breathe during inhalation of the medicament but closed when the device is in its cocked position.

The invention may include a medicator which comprises an inhalation actuable device as described above having a pressurised aerosol dispensing container located therein, said container being filled with a composition comprising a medicament suitable for inhalation therapy and an aerosol propellent.

In a preferred form of the invention the inhalation device includes an actuating lever which is adapted on operation under the influence of the spring means to depress the valve nozzle of the container whereby the container discharges a metered amount of aerosol compound into the chamber.

The actuating lever is conveniently pivotally mounted within the chamber and has a portion adapted to press against the valve nozzle of the container. In addition the actuating means may include a linking lever pivotally mounted within the chamber, the linking lever having a catch means at one end adapted to co-operate with latch means on the actuating lever and being linked to the moveable wall portion at the other end. A spring means in the form of a tension spring is conveniently provided to urgent the actuating lever against the valve nozzle of the aerosol container and the arrangement is such that in use deflection of the moveable wall portion in response to suction applied to the mouthpiece causes the linking lever to pivot and disengage its catch means from the latch means on the actuating lever so that the actuating lever depresses the valve nozzle under the influence of the tension spring.

Repetition of the single discharge cycle is possible only upon re-engagement of catch and latch and tensioning of the spring by manual resetting of the mechanism, such as by a flexible member attached to the actuating lever and projecting from the chamber through an orifice in the wall thereof.

Two embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, wherein:

Figure 1 is a side elevation of the device according to a first embodiment of the invention, seen from the side of the mouthpiece;

Figure 2 is a section on lines 2—2 of Figure 1;

Figure 3 is a section similar to Figure 2 of the control compartment only, with the air valve open, the latch and catch levers disengaged after actuation of the membrane, and with the pressurised aerosol dispensing container discharging;

Figure 4 is a section on lines 4—4 of Figure 2;

Figure 5 is a section on lines 5—5 of Figure 4;

Figure 6 is an elevation on a smaller scale of a modified form of the lower part of the device shown in Figure 2;

Figure 7 is a fragmentary section on 2—2 of Figure 1 indicating a modification with a bellows device instead of the membrane of Figures 2 to 5;

Figure 8 is a fragmentary section on 2—2

of Figure 1 indicating a further modification with a piston instead of the membrane;

Figure 9 is a side elevation and Figure 10 a top plan view on a larger scale of a second embodiment of the invention;

Figure 11 is a section on an enlarged scale on lines 11—11 of Figure 9 showing the resetting and cover mechanism in locked position, with the latch slightly beyond cocking position to permit return to latch and catch engagement after accidental depression of the membrane;

Figure 12 is a fractional section similar to Figure 11 but showing latch and catch in cocked position upon unlocking and release of the resetting strap;

Figure 13 is a section similar to Figure 11, showing the device in operation during inhalation;

Figure 14 is a section on lines 14—14 of Figure 11;

Figure 15 is a section on lines 15—15 of Figure 11;

Figure 16 is a fractional section on line 16—16 of Figure 11, showing the hinge of the aerosol container holder;

Figure 17 is a view of the multiple purpose strap;

Figure 18 is a front elevation of the discharge nozzle;

Figure 19 is a bottom view of the discharge nozzle; and

Figure 20 is an elevation of the linking lever.

Description of a First Embodiment

Referring to Figures 1 to 5, the device according to this embodiment of the invention comprises a housing 10 for holding a conventional pressurised aerosol container 20 and a chamber 11 into which the aerosol container is adapted to discharge. A lower part 12 of the housing 10 is joined to the remainder of the housing by a bayonet joint as indicated at 14 of Figure 1. The lower part 12 of the housing 10 has an internal elastic, e.g. rubber, biasing cushion 15 (Figure 2) and the housing has a sealing gasket 16 which together support the aerosol container 20 securely within the housing, between the base 12.1 of the housing 12 and a wall 21 disposed between the chamber 11 and housing 12. Wall 21 is pierced with an opening 20.1 through which the neck of the container 20 projects. Discharging valve nozzle 21.1 of the container 20, on stem 21.2, reaches well into the chamber 11 into the proximity of, and for actuation by the projection 68 of lever 61, as will be described below. The chamber 11 has four indentations 18.1, 18.2 (Figures 1, 2, 3 and 4) and 19.1, 19.2 (Figures 2,4) which form interior recesses accommodating the actuating mechanism and provides walls for mounting pins, as will be described below.

The chamber 11 has a mouthpiece 22 constituting a suction and discharge aperture, an opening 23, and a valve port 24. The opening 23 is covered by an air pressure deflectable member, constituting a moveable wall portion of chamber 11 such as a plastic or rubber membrane 26 stretched over the opening 23 and suitably sealed to adjacent rim 23.1 of the chamber 11.

A force transmitting member 31 has a flat disc shaped portion 32 located in close proximity to membrane 26. A pair of arms 33 and 34 extend downwardly from the disc 32. These arms carry pins 36 and have slots 37, 38 (Figures 2, 3, and 5). The slots 37, 38 slide on a pin 39 pressed into the walls 41, 42 formed by the indentations 19.1, 19.2, as indicated in Figures 2, 4 and 6. As shown in Figures 2, 3, 4 and 5 the pin 39 also serves as a pivot for hub 62 of an actuating lever to be described hereinbelow, in addition to guiding the slots of arms 33 and 34.

A linking lever 51 is pivoted on pin 52 fixed on walls 43, 44 of the indentations 18.1, 18.2, as shown in Figure 4. This linking lever is a bell crank with a hub 53 (Figure 4) for pin 52. One arm 51.1 has at its end a catch surface 55 (Figures 2 and 3). The other arm 51.2 is forked at its end to provide tines 51.21 and 51.22 (Figures 3 and 4). Each tine 51.21, 51.22 is slotted for insertion of pins 36 to transmit motion from member 31 to the lever 51.

An actuating lever 61 also in the shape of a bell crank is pivoted with a hub 62 on the pin 39 which, as mentioned above, also guides the arms 33, 34 of the member 31. At the end of its arm 61.1, the actuating lever has a latch 64 (Figure 5). The other arm 61.2 of the lever 61 carries a stud 63 with a valve body 65 (Figures 2 and 4). This valve body 65 is made of material capable of sealing the valve opening 24, e.g. soft rubber. The stud 63 has attached thereto a cord 66 with suitable gripping means such as a ball 67 which permits resetting of the mechanism by pulling thereon, as will be described. A projection 68 of the latch arm 61.1 of actuating lever 61 is arranged in operation of the device to contact the valve nozzle 21.1 of the aerosol container 20.

A spring 71 is stretched between the lever 51 and the lever 61, biasing the levers 51 and 61 in clockwise direction and normally retains the catch and latch portions 55 and 64 in contact. It will be noted that the clockwise torque on lever 51 is slight as compared with that on lever 61. The valve body 65 is made of highly compressible material so that the relative positions of the latch and catch members is not critical.

As shown in Figure 6, the lower part 12 of the housing 10 can be made integral with the aerosol container as indicated at 12.1 and provided with bayonet slots 14.1 to fit corresponding pins of the remaining part of the housing.

Instead of the above described membrane

constituting a moveable wall portion of the chamber 11, a bellows device such as shown in Figure 7 can be used. In that Figure, the rim 23.1 of the compartment 11 carries, suitably sealed thereto, a commercially available bellows ring 126 which at its outer end is similarly sealed to a plate 132 which is somewhat larger than the disc 32, the device shown in Figure 2.

A further modification is shown in Figure 8. In this modification, the chamber 11 has an extended cylindrical rim portion 123, and a disc 232 has an inwardly extending sleeve 226.

The operation of the device described in Figures 1 to 8 is as follows.

In its normal rest position the device is in the condition shown in Figure 2, with the catch 55 and the latch 64 engaged, the valve 24, 65 closed and the projection 68 of lever 61 spaced from the nozzle portion 21.1 of the aerosol container 20.

When the patient inhales through the mouthpiece 22, the membrane 26 is deflected inwardly, the force developed by inhalation being dependent upon the area of the membrane. Upon moving inwardly, the membrane presses against the disc 32 of the member 31 which causes the lever 51 to rotate counterclockwise against the force of spring 71. Upon the counterclockwise rotation of lever 51 the catch 55 releases the latch 64 and the lever 61 thereupon is moved clockwise by the spring. This movement takes place with considerable force and the projection 68 of lever 61 presses on the nozzle portion 21.1, causing it to deliver a single metered quantity of respiratory drug. At the same time, with lever 61 rotating clockwise, the valve body 65 is lifted from the seat 24 allowing free air to enter the inside of the chamber 11 and this air is inhaled by the patient substantially simultaneously with the respiratory drug. The pressure reduction required for operating the device and the ingress of air through the valve 24, 65 can be readily predetermined to facilitate deep penetration of medicament into the respiratory tract of a patient.

Upon delivery of this single discharge of medicament which cannot be repeated by consecutive inhalations, the device has to be reset by pulling the ball 67 which rotates lever 61 counterclockwise, closes the valve 24,65 and re-engages the latch and catch members, levers 51 and 61 and lifts the projection 68 from the nozzle portion 21.1 of the aerosol container. The device is thereupon ready for the next discharge.

Description of a Second Embodiment

Referring to Figures 9 to 20 the second embodiment has an ultimately integral casing indicated by 100 in Figures 9, 10 and 11, consisting initially of two shells 101, 102, respectively, which after assembling the internal mechanism are temporarily joined by interlocking the tongue and groove profiles indicated by 100.1 in Figures 14 and 15. These profiles are moulded in the shell edges, except for the five openings to be described below. The two shells are mirror images of each other, except for a few details such as locating pins which are standard expedients in this technique of fabricating moulded articles.

As indicated in Figures 11, 14 and 15, the casing 100 comprising housing 107 for an aerosol dispensing container 120 which housing is divided from a chamber 103 containing the actuating mechanism of the device by a partition 108. The chamber 103 has a mouthpiece 122, a valve port 124, and an opening 125 for the container 120. The wall of the chamber opposite the partition 108 is initially open with a peripheral groove 109 and a lip 100.2 (Figure 11) to which an air deflectable membrane 126 is sealed upon completion of the assembly. The partition 108 leads into the front wall of the casing with a ledge portion 121 which surrounds an opening 120.1 for the neck of the container 120. In contrast with the first embodiment with a normally upright aerosol dispensing container, in this embodiment the container is inserted with its discharging valve nozzle block 121.1 and stem 121.2 pointing downwardly. The nozzle block reaches into an actuating lever 161 as will be described below.

In addition to the above described openings, chamber 103 has a slot 124.1, next to the valve port 124, for insertion of a resetting strap 182 to be described below.

The opening 125 for inserting the container 120 is provided with lid 112 which is hinged to the side walls of the housing 107 by means of two stubs 112.1 (Figure 16), one extending on each side of the lid which are pivoted in corresponding recesses 112.2 of the walls At the other end of the lid 112 is a ratchet lock with a grip handle 112.5 and teeth 107.1, 107.2 on either side thereof (Figure 10) which engage corresponding teeth 107.5, 107.6 on either side of a cutout 107.8 (Figures 10 and 11) of the front wall of the housing. By means of the grip 112.5, the respective teeth can be engaged thereby firmly pressing the container 120 against the ridge 121 thus securely attaching and satisfactorily sealing it to the housing 107. This ratchet lock of the container holder accommodates a generous tolerance latitude for somewhat varying lengths of container 120. It will be noted that crevices around the lid 112 are pneumatically inconsequential because the housing 107 is sealed from the chamber 103 at the ledge 121.

The membrane 126 of flexible material has a peripheral portion indicated by 126.1 (Figures 11, 14 and 15) which is shaped to engage a corresponding peripheral groove 109 and lip 100.2 of the chamber 103.

As shown in Figure 15 walls of the casing

are provided with recessed bosses 201, 202, 203, 204 serving to receive the stud fulcrums of the levers to be described below. In addition, the side walls have recesses, similar to the lid pivot recesses marked 112.2 in Figure 16 to accommodate a pin 172 for the fixed end of spring 171.

A force transmitting member consists in this embodiment of a plate 132 (Figures 11 and 14) which two flanges 133, 134 which have split pivot holes 135 (Figure 11) for receiving the pivot pin 136 of a linking lever 151. The plate 132 extends practically over the entire area of the membrane 126, as shown in Figures 11, 14 and 15.

The linking lever 151 (Figures 11, 14, 15, 20) is pivoted on two studs 151.1, 151.2 in the recessed bosses 202, 204 above described with reference to Figure 15. The linking lever also incorporates rotatable pin 136 extending on either side of the hub 136.1, engaging and pivoted in the split holes 135 of the two flanges 133, 134 of the plate 132. A saddle 137 of lever 151 receives lateral bias of the spring 171 (Figures 11 and 14). The other end of the linking lever 151 is moulded to form between the studs 151.1 and 151.2 a catch face 155 as shown in Figures 11 and 20. The above described parts of the linking lever 151 are moulded in one piece.

The actuating lever 161 (Figures 11, 14 and 15) has two flanges 161.1 and 161.2 and a web 161.3 with a cross bridge 162.4. The web 161.3 has a bulge or cam projection 168 for contacting the nozzle block 121.1 of the container 120 during operation as indicated in Figure 13. The actuating lever 161 is pivoted on two studs 161.6 and 161.7 (Figure 15) in the recessed bosses 201 and 203 of the casing. Opposite the pivot 161.6, 161.7, the actuating lever has latch faces 162 recessed on the two flanges 161.1, 161.2 and thus adapted to engage the catch face 155 of the linking lever 151. Opposite the bridge 162.4, the web 161.3 carries a valve body 165 of material capable of sealing the valve opening 124, such as soft rubber as described in the first embodiment. Attached to a lip 163 of the actuating lever is a cover 181 with a pull strap 182, a breathing aperture cap 185 and a pull tab 186 (Figures 9, 11, 13 and 17). The end of the strap 182 passes through the slot 124.1 of the chamber 103 and is scored just outside thereof as indicated at 183 in Figures 11 and 17. A tab portion 184 of the strap is sufficiently long and wide to cover the valve aperture 124 at the bottom of the chamber 103 as indicated in Figures 11 and 9 and then widens to form a cap portion 185. It ends in a tab and locking portion 186 which has a lip 187 formed to interlock with a corresponding rim 188 of the mouthpiece 122. If this locking arrangement is disengaged and the strap 184 hangs down, the scored strap end 182 and a portion of 184 which is attached to the lever 161 is capable of passing through the slot 124.1, permitting the lever 161 to move inwardly.

At the end of the lever 161 remote from pivot 161.6 is provided a hole 180 for a hook at one end of the spring 171 which is at its other end attached to pin 172 inserted between two recesses of the casing, as above described. This spring 171, stretched between the points 172 and 180, contacts the saddle 137 of the linking lever 151 at its moving pivot on the plate 132, biasing the plate towards the membrane 126.

The two flanges 161.1, 161.2 of the actuating lever 161 secure the nozzle block 121.1, which has flat faces as shown in Figure 18, against rotation while the block is not in contact with a projecting portion 168 of the actuating lever web 161.3. As indicated in Figures 18 and 19, the nozzle block has preferably on its lower face an indicator, such as an arrow 191 in order to facilitate insertion of the container with its orifice 192 pointing in the correct direction.

The above described embodiment is made from suitable plastics material, such as medium impact polystyrene for the internal mechanism and the housing proper, a softer material such as "Thermolastic" available under that trade mark from the Shell Company for the breath responsive membrane, and polypropylene for the cover 181 with tab and cap and the container holder 112.

For assembling the device, the mechanism with the two levers, the spring, the pins, and also the strap and container holder are in proper relation located in one shell, and the other shell is then snapped on by means of the tongue and groove edges. The membrane is applied in similar fashion. The two shells are then permanently sealed to each other, and the membrane to the shells, by applying ultrasonic vibration energy in the manner well known in the art of fabricating plastics articles.

The casing is essentially a parallelepiped with the membrane 126 forming one long and narrow side thereof, the opening for the container 120 in one short and narrow side, the air admission port in the other short and narrow side, and the suction and discharge aperture at the edge formed by the other short and narrow side and the long and narrow side opposite the membrane. The partition 108 of the bottle compartment is generally parallel to the membrane 126 and the ledge 121 is normal thereto.

The operation of the above described second embodiment of the invention is as follows:

In order to make the device ready for operation, the lid 112 is opened, an aerosol dispensing container 120 of suitable size is inserted in inverted position, and the lid secured with the ratchet lock. During insertion of the container 120, the nozzle block is advanced through the opening 120.1 of the rim 121 until

flanked by the two flanges of the actuating lever 161 as shown in Figure 15. Correct placement of the nozzle orifice 192 is facilitated by the arrow embossed on the block, as shown in Figure 19. The cover 184 is by its tab 186 pulled over the valve port 124 and the mouthpiece 122, and secured by engaging the tab with the lip 188. In this condition the device is protected against accidental operation incuding depression of the membrane 126 and can be safely carried in a pocket or bag.

For using the device, the strap 181 is released at its locking portion 186, 187 to uncover the mouthpiece 122 and also the valve port 124. Subsequent to inhalation, it will then be in the position shown in Figure 13. As indicated by the facial silhouette in Figure 13, prior to inhalation the mouthpiece 122 is inserted in the mouth of the patient who can easily hold the device in one hand since it can be made very small, such as not more than about four inches high. The first inhalation will deflect the membrane 126 as indicated in Figure 13, moving the plate 132 against the pressure of spring 171 on its saddle 137, which is incidental to operation but desirable for resetting. The lever 151 turns on its pivot 151.1 and 151.2 and releases the catch 155 from the latch 162 of the actuating lever 161. This lever, turning on its pivots 161.6, 161.7 is pulled forcefully upwardly by the spring 171, and its projecting 168 pushes the nozzle block upwardly, thus causing the aerosol dispensing container to discharge as indicated by arrows in Figure 13. Air is simultaneously admitted through port 124.

As described above with reference to the first embodiment, the above outlined single discharge cannot be repeated by consecutive inhalation since latch and catch are safely disengaged with the nozzle block maintained in its depressed position by the tension of the spring 171. For repeated use, the device has to be reset by pulling on the strap 181 which will turn the lever 161 downwardly for engagement of its latch 162 with the catch 155 of the linking lever 151. The operation can then be repeated, or if the treatment is for the time being terminated, the tab 186 is again engaged at 188 thus safely seuciring the lever 161 in its cocked position and at the same time closing the mouthpiece 122 with the cap 185, and the valve with the strap 182. It will be evident that storing of the cocked device with the cover 181 hanging down would be quite inconvenient, the tab reminding the user of the insecured position, and providing strong inducement to lock the cap.

It will now be evident that the second embodiment facilitates manufacture and provides a particularly simple as well as accident and tamperproof construction. It has been found that the spring as used in the second embodiment provides high impact energy for actuating the aerosol dispensing container and is effectively responsive to slight inhalation under pressure, by biasing the linking member against the side of the spring at right angles to a line between the spring anchorage points.

In constructing devices in accordance with the invention, it should be borne in mind that the normal maximum negative pressure which can be produced by humans on inhalation is about 250 mms. of water. Thus the inhalation responsive member (e.g. membrane 26 in Figures 1 to 5, the bellows device of Figure 7, the piston device of Figure 8, or the membrane 126 of Figure 11), should be designed to be responsive to negative pressures of 250 mms. of water or less. At the otser end of the scale, the inhalation responsive member should desirably not respond to very feeble negative pressures since otherwise the medicament will not be realised at the optimum point in the breathing cycle. Thus generally we prefer to provide a responsive member which will respond to negative pressures within the range of 20 mms. to 250 mms. of water.

It will be noted that in all the embodiments shown in the accompanying drawings, the inhalation responsive member is exposed. We believe that frequently this will be appreciated by many doctors and patients since they may wish to test the devices manually by depressing the exposed surface of the responsive member when the device is in its cocked condition. However, this arrangement may be disadvantageous and lead to misuse. Thus it is within the scope of the present invention to provide a cover over the exposed surface of the responsive member. This cover may be removable and/or apertured. Such aperture or apertures may be large enough to allow insertion of a probe such as a pencil or a special key for testing purposes.

While in the embodiments specially described the aerosol container remains stationary and the valve nozzle is depressed through the agency of the spring means, alternative embodiments will occur to the skilled reader in which the nozzle is held stationery and the container moved under the influence of the spring means to open the valve of the container. Such embodiments may involve applying spring pressure to the aerosol container tending to press the container axially towards the nozzle which is held stationery. Locking and latching devices coupled to the inhalation responsive member may retain the container in its cocked position until actuated by suction applied to the mouthpiece.

WHAT WE CLAIM IS:—

1. An inhalation actuable dispensing device for use with a conventional pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle and being of the type which is capable of releasing a metered amount of an aerosol compound on depression of the valve nozzle, said device comprising a chamber having a mouth-

piece, an air admission port, actuating means including spring means, disposed within said chamber for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means comprising a moveable wall portion of the chamber which is deflectable in response to suction applied to the mouthpiece to release said latch means, whereby in use of the device said actuating means causes depression of the valve of the aerosol dispensing container and discharge of a metered amount of aerosol compound into the chamber in the vicinity of the mouthpiece.

2. A device according to claim 1 in which said air admission port is closed while the actuating means, is in its cocked position, said port being opened to admit ambient air on operation of said actuating means in response to suction applied to the mouthpiece.

3. A device according to claim 1 or claim 2 in which said actuating means includes an actuating lever which is adapted on operation under the influence of said spring means to depress the valve nozzle of the container whereby the container discharges a metered amount of aerosol compound into said chamber.

4. A device according to any one of the preceding claims which includes a housing for the aerosol dispensing container adjacent to said chamber and having an aperture through which the valve nozzle may project into the chamber, said device including means for holding the container firmly within the housing.

5. A device according to claim 4 in which the housing for the aerosol dispensing container is closable by a lid which is pivotally mounted at one end to the housing and at its other end is formed with teeth which are engageable with corresponding teeth formed on the housing to lock the lid in a closed position in contact with the base of the aerosol dispensing container.

6. A device according to any one of the preceding claims in which the movable wall portion comprises a piston member, a bellows or deflectable membrane.

7. A device according to any one of the preceding claims in which the moveable wall portion is provided with an apertured cover.

8. A device according to any one of the preceding claims in which the actuating means comprises an actuating lever pivotally mounted within said chamber and having a portion adapted to press against the valve nozzle of the container, a linking lever pivotally mounted within said chamber and having a catch means at one end adapted to co-operate with latch means on said actuating lever and being linked to the moveable wall portion at the other end and in which the spring means is a tension spring tending to urge the actuating lever against the valve nozzle, the arrangement being such that in use deflection of said moveable wall portion in response to suction applied to the mouthpiece causes the linking lever to pivot and disengage its catch means from latch means on said actuating lever, whereby the actuating lever depresses the valve nozzle under the influence of said tension spring.

9. A device according to claim 8 which includes resetting means comprising a flexible member connected at one end to the actuating lever and passing through an orifice to the outside of the chamber, the arrangement being such that by pulling on the flexible member the actuating lever is moved against the force of the tension spring and the catch and latch means re-engaged.

10. A device according to claim 9 in which the flexible member comprises a flexible strap having an end portion which is engageable with a lip on the mouthpiece to close the mouthpiece and to maintain the device in a condition suitable for transport or storage.

11. An inhalation actuable dispensing device for use with a pressurised aerosol dispensing container, said container having a container body and a projecting valve nozzle which is capable of releasing a metered amount of an aerosol compound upon relative movement of the valve nozzle and the container body towards one another, said device comprising a chamber having a mouthpiece, an air admission port, actuating means including spring means for causing actuation of the valve of the aerosol dispensing container, latch means for holding the actuating means in a cocked position against the force of the spring means and triggering means responsive to suction applied to said mouthpiece to release said latch means whereby in use of the device said actuating means causes actuation of the valve of said aerosol dispensing container and discharge of a metered amount of an aerosol compound into the chamber in the vicinity of the mouthpiece.

12. A device according to claim 11 in which said spring means is adapted to apply pressure to the aerosol container tending to press the container axially towards the valve nozzle which is adapted to be held stationary relative to the chamber.

13 A device according to claim 11 or claim 12 in which said triggering means comprises a moveable wall portion of said chamber deflectable in response to suction applied to the mouthpiece.

14. A device according to claim 13 in which the moveable wall portion is provided with an apertured cover.

15. A device according to claim 13 or claim 14 in which the moveable wall portion is a piston member, a bellows or deflectable membrane.

16. A device according to any one of claims

11 to 15 in which said air admission port is closed while the actuating means is in its cocked position, said port being opened to admit ambient air on operation of said actuating means in response to suction applied to the mouthpiece.

17. A device according to any one of claims 11 to 16 in which said actuating means includes an actuating lever which is adapted on operation under the influence of said spring means to actuate the valve of the container whereby the container discharges a metered amount of aerosol compound into said chamber.

18. A device according to any one of claims 11 or 13 to 17 which includes a housing for the aerosol dispensing container adjacent to said chamber and having an aperture through which the valve nozzle may project into the chamber, said device including means for holding the container firmly within said housing.

19. A device according to claim 13 or a claim appendent thereto in which the moveable wall portion is deflectable in response to negative pressures within the range of 20 mms. to 250 mms. of water.

20. An inhalation actuable dispensing device substantially as described with reference to and as illustrated in Figures 1 to 5 or as modified by Figures 6 or 7 or 8 of the accompanying drawings.

21. An inhalation actuable dispensing device substantially as described with reference to and as illustrated in Figures 9 to 20 of the accompanying drawings.

22. A medicator which comprises an inhalation actuable device as claimed in any one of the preceding claims having a pressurised aerosol dispensing container located therein, said container being filled with a composition comprising a medicament suitable for inhalation therapy and an aerosol propellant.

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Agents for the Applicants

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1288971 COMPLETE SPECIFICATION
6 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

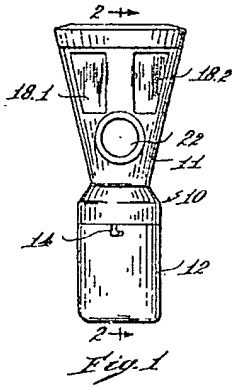

Fig. 1

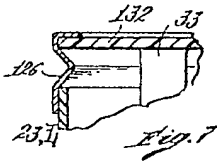

Fig. 7

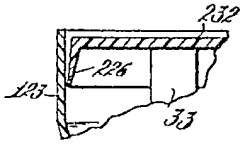

Fig. 8

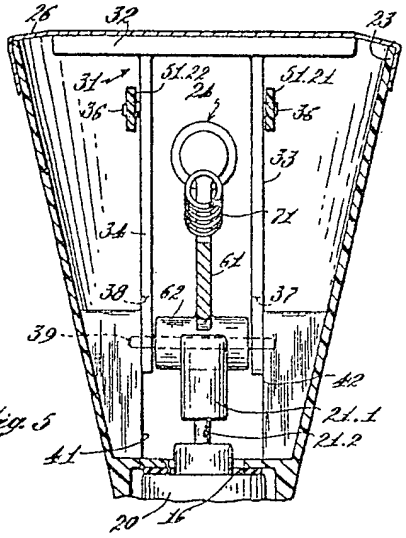

Fig. 5

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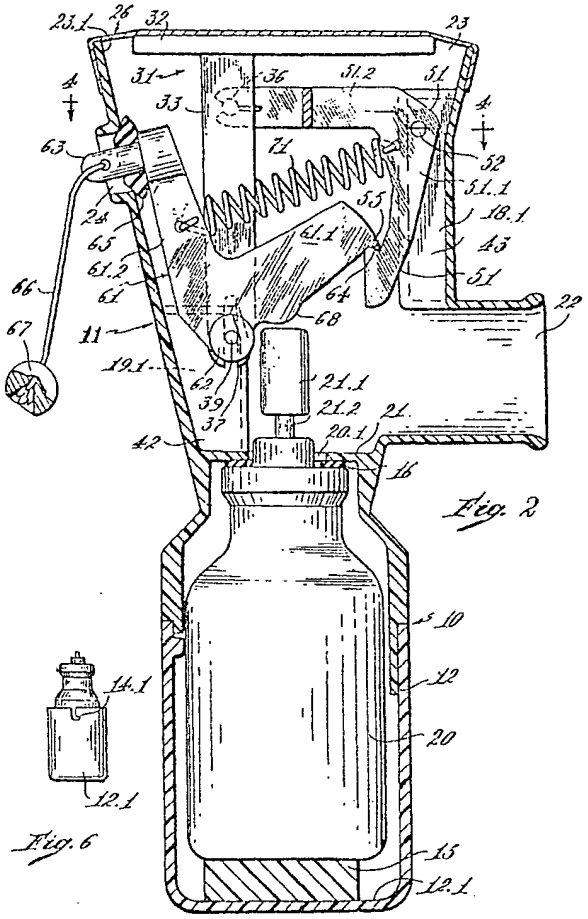

Fig. 2

Fig. 6

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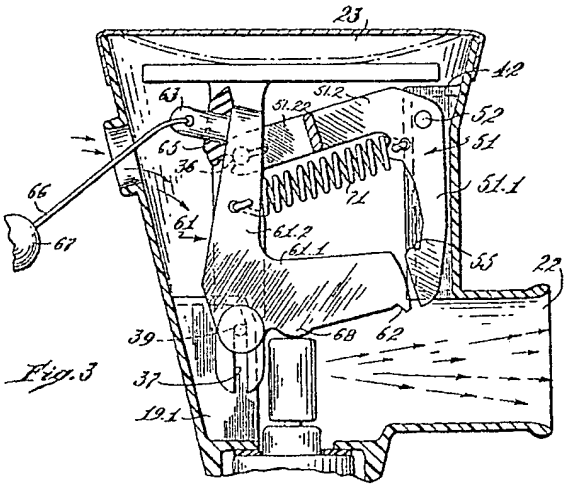

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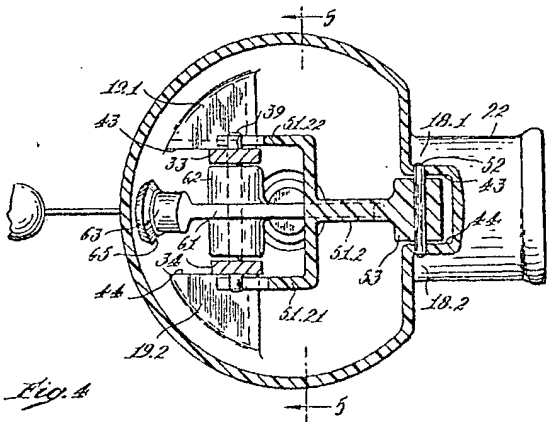
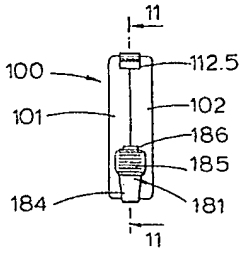


Fig. 4



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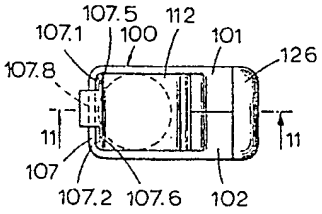

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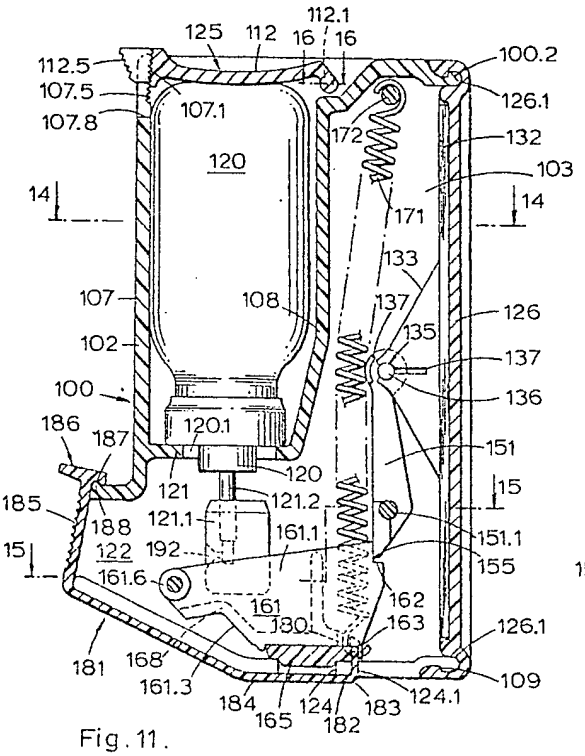

Fig.11.

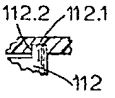

Fig.16.

Fig.12.

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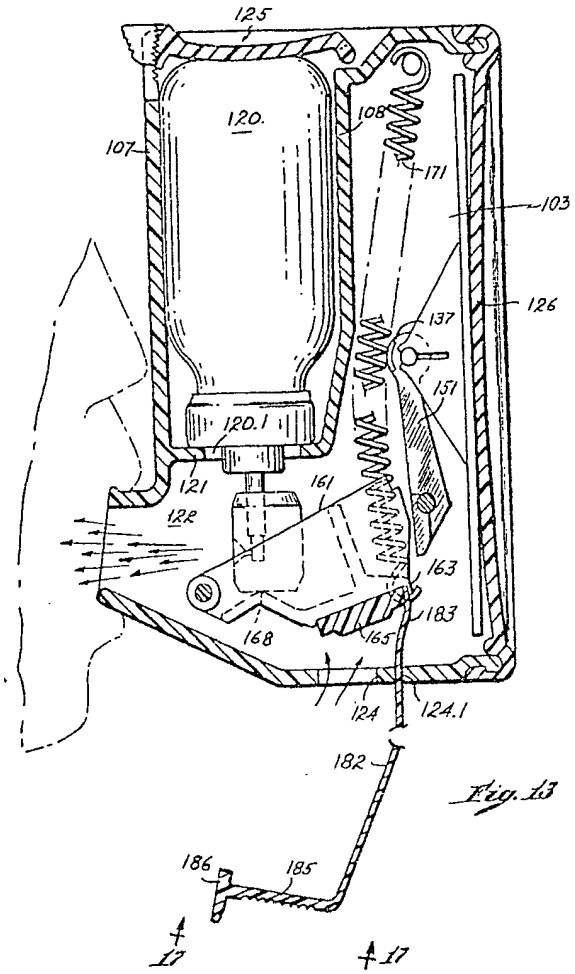

Fig. 13

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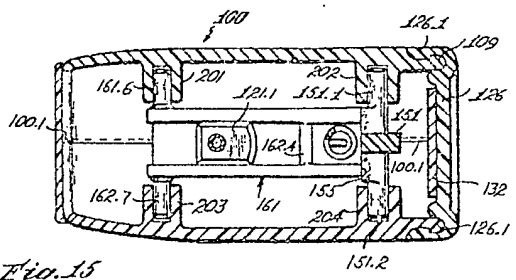
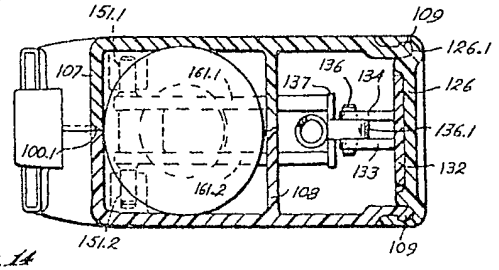


Fig. 15



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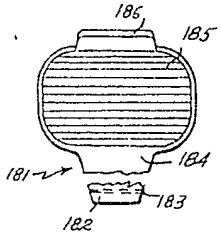

Fig. 17

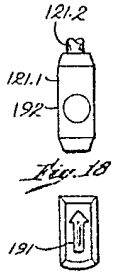

Fig. 18

Fig. 19

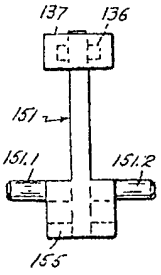

Fig. 20